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Management of AI chatbots in education: A systematic literature review

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Abstract

This systematic literature review (SLR) examines the current applications of AI chatbots in education by analyzing 30 peer-reviewed articles indexed in Scopus and published between 2020 and 2025. Following the PRISMA 2020 framework, this study addressed four key objectives: 1) to explore the current patterns of AI chatbot usage, 2) to identify and analyze the perceived benefits of AI chatbots in education, 3) to examine the key challenges of AI chatbots in education, and 4) to propose evidence-based management strategies that can support the responsible and effective implementation of AI chatbots in education. The study revealed that AI chatbots were predominantly employed to personalize learning, enhance student engagement, facilitate self-regulated learning, and streamline administrative tasks. Benefits included improved access to educational resources, enhanced writing and research skills, and more efficient classroom, management. On the other hand, concerns persist regarding data privacy, ethical implications, and academic integrity, particularly as students may leverage these tools for educational misconduct, alongside the potential negative impact on critical thinking skills. To mitigate this concern, the study suggested that institutions formulated clear policies, facilitate faculty training, align chatbot integration with pedagogical goals, and implement continuous evaluation mechanisms. The study aimed to provide evidence based – insight for educators, and policymakers involved in the integration of AI chatbots within educational settings.

Keywords: AI chatbots, education management, education technology, systematic literature review

Background and significance

Artificial Intelligence (AI) is transforming the way education works around the world. AI–powered chatbots are increasingly used to personalize learning and enhance engagement. Moreover, it provides administrative support, which helps teachers to save more time and can be more focused on the students (Kuhail et al., 2023; Lan & Zhou, 2025; Romero Alonso et al., 2025). The growing popularity of AI chatbots is also reflected in market trends. In 2024, the global AI chatbots market was worth about 8.6 billion US dollars, and it is expected to reach over 11.14 billion in 2025. By 2029, this number may rise to more than 31.11 billion, by a compound annual growth rate (CAGR) of 29.3%. This shows just how quickly this technology is spreading and growing (The Business Research Company, 2025).

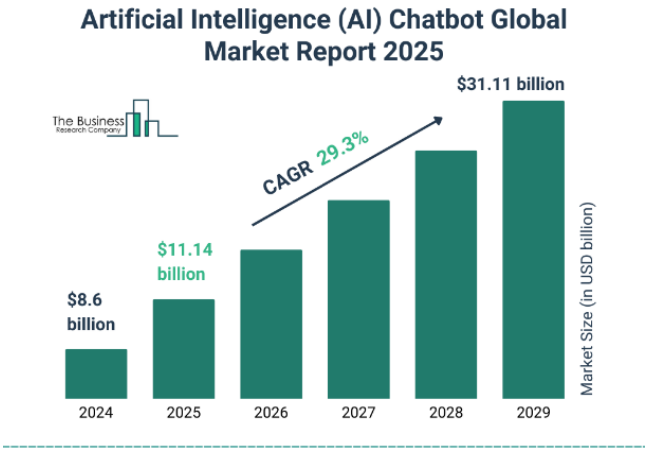

Figure.1 Artificial Intelligence (AI) AI Chatbots Global Market Report

Governments and educational institutions are also responding to this trend. In the UK, the Department for Education now encourages teachers to leverage AI tools for automating routine tasks to save more time and can have more focus on students, while emphasizing transparency and risk management (Shearing, 2025). Similarly, more than 100 Canadian universities and colleges are integrating AI chatbots into digital textbooks to offer personalized feedback and flexible learning opportunities (Tang, 2024). These examples illustrate policy trends but are not part of the academic literature reviewed.

Recent academic studies highlight AI chatbot use for personalized learning, engagement, and administrative support (Ezzaim et al., 2023; Wiboolyasarin et al., 2025), help students manage their own learning to match with their learning style (Lan & Zhou, 2025), keep learners more engaged (D'Mello et al., 2024), and even encourage teamwork and collaboration (Zapata et al., 2024).

However, AI chatbots also brings several challenges including data privacy, algorithmic bias, academic integrity, and impacts on critical thinking. There are ongoing discussions about student data privacy and the security of the information shared with AI chatbots (Almalki et al., 2025; Mat Yusoff et al., 2025). Some researchers are also concerned about AI spreading false or biased information, which can cause some misunderstanding and trust

issues (Heil et al., 2025; Winkler et al., 2023). Another major challenge is academic honesty, as some students might use AI in ways that lead to plagiarism or make them too dependent on it for thinking and writing (Dhamija & Dhamija, 2025; Elliott et al., 2025). According to the challenges that have been mentioned, teachers need to be informed about how overusing AI chatbots could make students less skilled at thinking critically or solving problems (Kim et al., 2025; Zhang et al., 2025).

Many schools and universities still do not have solid systems in place to manage how AI chatbots are used in education (Fullan et al., 2024; Saleh et al., 2025). There is a strong need for practical, research–based guidelines that help ensure chatbot use aligns with pedagogical goals and institutional values. (Trindade et al., 2025; Yang et al., 2025).

This study focuses on literature published within the past five years (2020–2025), following the methodological recommendations of Xiao & Watson (2017). By systematically analyzing recent research, this study aims to provide a comprehensive understanding of how AI chatbots are currently used in education, the benefits and challenges they provide, and the strategies required to manage their AI chatbots in education responsibly. The goal is to inform educators, administrators, and policymakers who are willing to use AI chatbots in education effectively and efficiently.

Objectives

1. To explore the current patterns of AI chatbots usage in education
2. To identify and analyze the perceived benefits of AI chatbots in education
3. To examine the key challenges of AI chatbots in education
4. consolidate evidence–based management strategies for AI chatbot integration

Literature reviews

In recent years, the usage of AI chatbots in education has been growing. Researchers, teachers, and policymakers are paying more attention to this trend, as the studies show that this trend is changing quickly, with AI chatbots now being used for many different purposes. It helps with teaching and learning to handle day–to–day administrative tasks in schools and universities.

This section synthesizes insights from 30 peer–reviewed articles published between 2020 and 2025, providing an overview of current usage, perceived benefits, challenges, and emerging management practices of AI chatbots in education.

AI chatbots Usage in Education

The usage of AI chatbots has been increasing in education. According to Romero Alonso et al., 2025 and Kuhail et al., 2023, AI chatbots have been used in many ways in education such as enhance learning, facilitate communication, and support institutional operations. Many studies highlight their role in promoting personalized and adaptive learning experiences. As well as helping students to engage in self–regulated learning (Lan & Zhou, 2025), and fostering collaborative learning environments (D'Mello et al., 2024; Zapata et al., 2024). In language

education, AI chatbots have been found to enhance second–language acquisition by providing interactive and adaptive feedback (Wiboolyasarin et al., 2025).

Additionally, AI chatbots provide immediate and personalized feedback, which very convenience and it could support students outside the classroom as it is 24/7 services (Black & Tomlinson, 2025; Kang et al., 2024), it also provide support to teachers as automate administrative processes such as grading and scheduling (Meinlschmidt et al., 2025; Okonkwo & Ade–Ibijola, 2021), and support digital textbook and virtual classroom integration to make teachers works easier (Carson, 2024). These trends reflect the growing role of AI chatbots as integral components of modern digital learning ecosystems which could be something common in the future, according to the growth rate of these technologies.

Benefits of AI chatbots in Education

The study consistently highlights benefits that are related to AI chatbots in education. For example, enhanced accessibility to learning resources and personalized feedback is among the most frequently reported advantages as many studies mentioned (Chen et al., 2020; Ezzaim et al., 2023; Wiboolyasarin et al., 2025). AI chatbots support continuous learning by providing real–time feedback, which helps to improve student outcomes and engagement as the students could learn anywhere and anytime (D'Mello et al., 2024; Zapata et al., 2024). They also contribute to the development of academic writing and research skills (Kim et al., 2025; Winkler et al., 2023), and foster student motivation and self–efficacy as AI chatbots can detect how well each student is and what each student should improve individually (Mat Yusoff et al., 2025; Salama et al., 2025).

For the management perspective, AI chatbots enhance institutional efficiency by automating routine administrative tasks (Dhamija & Dhamija, 2025). Furthermore, they promote inclusive education by providing 24/7 support, particularly benefiting students with diverse learning needs such as shy students (Ortiz et al., 2025; Romero Alonso et al., 2025).

Challenges of AI chatbots in Education

Besides these benefits, AI chatbots in education also presents several challenges. Data privacy and security concerns are prevalent, with multiple studies calling for stronger institutional safeguards (Almalki et al., 2025; Mat Yusoff et al., 2025; Saleh et al., 2025). As well as, ethical risks, including algorithmic bias and the potential for misinformation, are also well documented as it can cause misunderstanding and losing trust (Heil et al., 2025; Fošner & Aver, 2025; Winkler et al., 2023).

Academic integrity remains a critical issue, with increased risks of plagiarism and over–reliance on AI–generated content, which could turn to some ethical concern as it might go wrong and cause inappropriate action or situation in the future (Dhamija & Dhamija, 2025; Elliott et al., 2025; Kim et al., 2025). Additionally, some educators are also worried that relying too much on AI chatbots might make it harder for students to develop important skills like critical thinking and deep problem solving (Adams & Thompson, 2025; Fullan et al., 2024). Another issue is that not everyone is familiar with how to use AI chatbots, which can make it harder to it in a fair and effective way (Heil et al., 2025; Yang et al., 2025).

Management of AI chatbots in Education

Effective management of AI chatbot integration is very important as it can create more benefits while preventing challenges which could happen in the future. Many studies highlight how important it is for schools and universities to have clear policies and ethical guidelines when using AI chatbots (Fullan et al., 2024; Saleh et al., 2025; Yang et al., 2025). Faculty training and professional development are also success factors that the schools and universities should provide as it is necessary (Meinlschmidt et al., 2025; Winkler et al., 2023). Researchers also suggest that AI chatbots should be designed in a way that aligns with pedagogical goals of each course and meets students' needs, so they can truly support better learning outcomes (Ortiz et al., 2025; Romero Alonso et al., 2025).

Collaborative approaches involving educators, technologists, and administrators are advised to ensure that AI chatbot integration supports institutional goals and educational values because by driving it to the wrong direction could create many challenges (Fošner & Aver, 2025; Trindade et al., 2025). Finally, ongoing evaluation and continuous refinement are essential to ensure that AI chatbots applications remain effective, ethical, and aligned with evolving educational needs (Tortella et al., 2025; Yang et al., 2025; Saleh et al., 2025).

Table 1 provides a summary of the 30 peer–reviewed articles published in Scopus–indexed journals between 2020 and 2025 were included in this study. The detailed synthesis of usage, benefits, challenges, and management strategies drawn from these studies is presented in the results section.

Table 1 Summary of the 30 peer–reviewed articles included in the review

No.	Author(s) and Year	Journal Name	Focus Area	Usage	Benefits	Challenges	Management
1	Adams & Thompson (2025)	Leadership and Policy in Schools	School leadership	√	√	√	√
2	Almalki et al. (2025)	BMC Medical Education	Medical education readiness	√	√	√	
3	Black & Tomlinson (2025)	Scientific Reports	Academic writing & research	√	√	√	√
4	Carson (2024)	Scandinavian Journal of Educational Research	Interprofessional expertise	√			
5	Chen et al. (2020)	Computers and Education: Artificial Intelligence	AI in education (general trends)	√	√		
6	Dhamija & Dhamija (2025)	Journal of Interdisciplinary Studies in Education	ChatGPT in higher education	√	√	√	√
7	D'Mello et al. (2024)	AI Magazine	Collaborative learning (AI partners)	√	√	√	√
8	Elliott et al. (2025)	Teaching and Learning in Nursing	Critical thinking in nursing	√	√	√	√
9	Ezzaim et al. (2023)	Journal of Universal Computer Science	Adaptive learning	√	√		
10	Fošner & Aver (2025)	Sustainable Futures	Student beliefs & concerns	√	√	√	√
11	Fullan et al. (2024)	School Leadership & Management	AI in school leadership	√	√	√	√
12	Heil et al. (2025)	Smart Learning Environments	AI competence & learning	√	√	√	√

Table 1 (continued)

No.	Author(s) and Year	Journal Name	Focus Area	Usage	Benefits	Challenges	Management
13	Kang et al. (2024)	Family and Consumer Sciences Research Journal	Fashion education	√		√	
14	Kim et al. (2025)	Scientific Reports	AI literacy		√	√	
15	Kuhail et al. (2023)	Education and Information Technologies	Educational AI chatbots (systematic review)	√	√	√	√
16	Lan & Zhou (2025)	npj Science of Learning	Self-regulated learning	√	√	√	√
17	Mat Yusoff et al. (2025)	Discover Computing	AI in higher education	√	√	√	√
18	Meinlschmidt et al. (2025)	BMC Medical Education	Professional communication	√	√	√	√
19	Okonkwo & Ade-Ibijola (2021)	Computers and Education: Artificial Intelligence	Educational AI chatbots (systematic review)	√	√	√	√
20	Ortiz et al. (2025)	JAMA Network Open	AI in healthcare screening	√	√	√	√
21	Romero Alonso et al. (2025)	RIED-Revista Iberoamericana de Educación a Distancia	Distance education personalization	√	√	√	√
22	Salama et al. (2025)	BMC Nursing	AI perceptions in nursing		√		
23	Saleh et al. (2025)	BMC Nursing	Faculty perceptions of AI chatbots	√	√	√	√
24	Tortella et al. (2025)	BMC Medical Education	Physiotherapy education	√	√	√	√
25	Trindade et al. (2025)	International Journal of Management Education	Math education with AI	√	√	√	√
26	Wiboolyasarin et al. (2025)	Ampersand	Second language education	√	√	√	√
27	Winkler et al. (2023)	Entrepreneurship Education and Pedagogy	Entrepreneurship education	√	√	√	√
28	Yang et al. (2025)	Humanities and Social Sciences Communications	AI literacy education	√	√	√	√
29	Zhang et al. (2025)	Scientific Reports	Higher-order thinking	√	√	√	√
30	Zapata et al. (2024)	Ubiquitous Learning: An International Journal	Collaborative learning	√	√	√	√

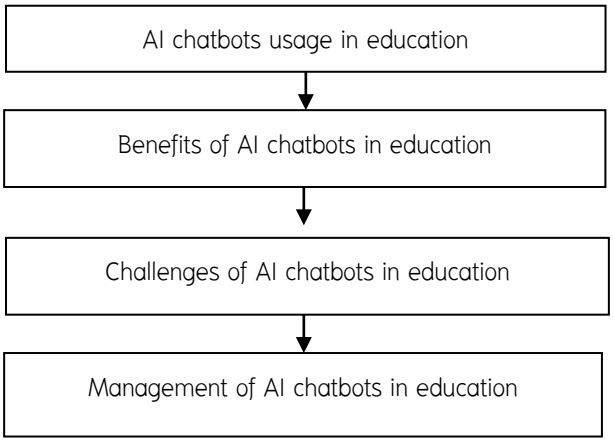

Figure. 2 Conceptual framework

Methods

1. Population and samples

This study employed a Systematic Literature Review (SLR) approach, following the PRISMA 2020 guidelines (Page et al., 2021), to ensure a transparent, rigorous, and replicable review process. The review focused on synthesizing current knowledge regarding the integration of AI chatbots in education, specifically analyzing their usage patterns, perceived benefits, challenges, and management strategies.

This review targeted peer-reviewed articles published in Scopus-indexed journals between 2020 and 2025. The target population comprised academic studies that examined the management, usage, benefits, and challenges of AI chatbots in educational contexts.

A comprehensive search process was conducted, following inclusion and exclusion criteria. The inclusion criteria required that articles:

1) Focused on AI chatbot applications in education

2) Were peer-reviewed and indexed in Scopus

3) Published between 2020 and 2025

4) Written in English

Articles such as conference proceedings, editorials, and non-peer-reviewed publications were excluded. After screening, 30 articles were included in the final synthesis.

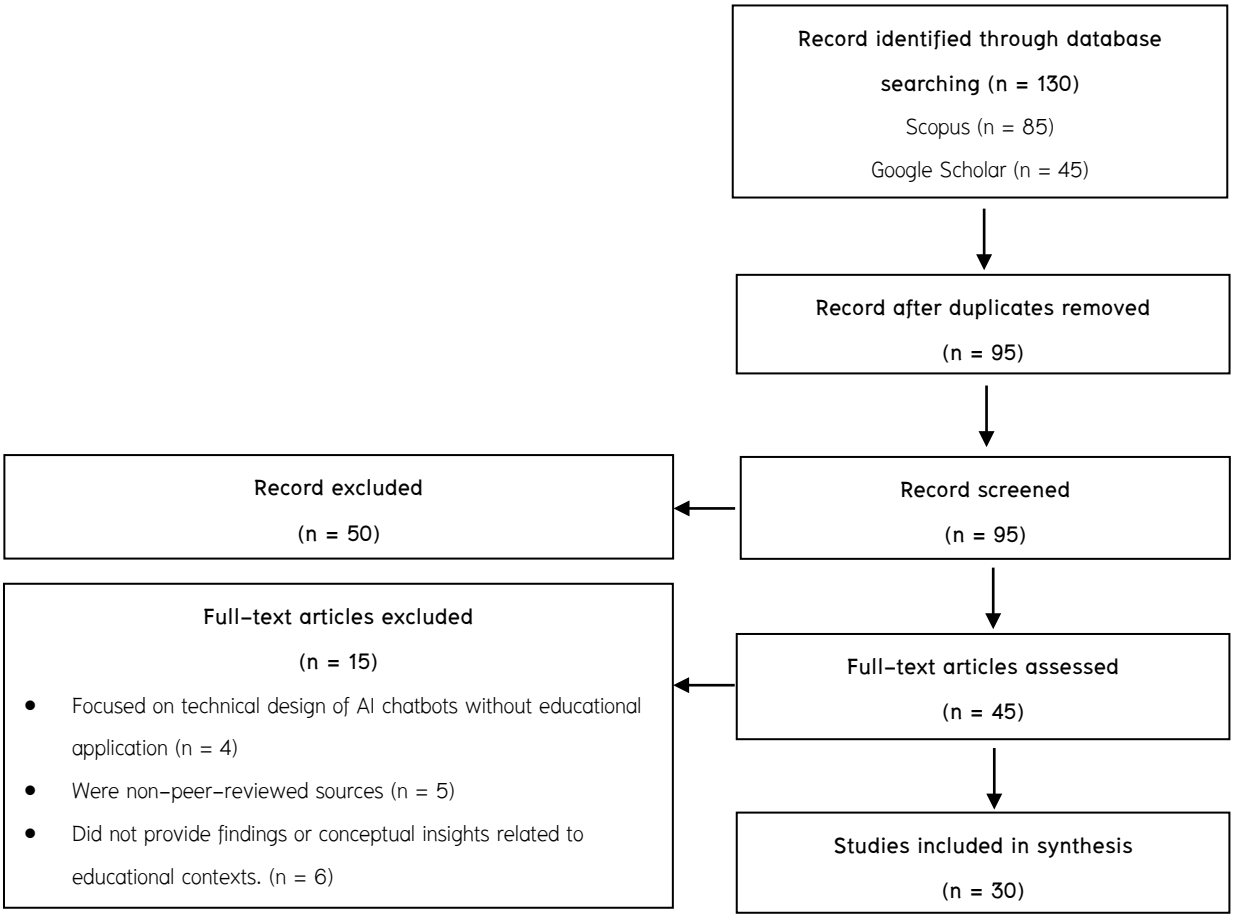

Figure. 3 PRISMA flow diagram

2. Research tools

This review utilized tools and procedures recommended by the PRISMA 2020 guidelines (Page et al., 2021) to ensure transparency, rigor, and replicability.

The primary tool guiding the review was the PRISMA 2020 Checklist, which supported systematic reporting across all stages of the review, including defining research questions, search strategy, article selection, data collection, and synthesis. Additionally, the PRISMA flow diagram (Figure. 3) was employed to illustrate the selection process of included studies, providing clear documentation of the number of records identified, screened, and included.

Systematic research was performed across major academic databases, including Scopus and Google Scholar. Supplementary manual searches of reference lists were also conducted to ensure comprehensive coverage of relevant literature.

Data from the selected articles were manually analyzed through thematic synthesis, following guidance from SLR methodologies (Xiao & Watson, 2017). The resulting themes and extracted information were organized using Microsoft Excel to facilitate clarity and consistency in synthesis.

3. Data collection

Data sources and search strategy

A comprehensive search was conducted across the Scopus database and Google Scholar to ensure broad coverage of relevant literature. The search was performed in May 2025 and included combinations of the following keywords: "AI chatbots," "artificial intelligence AI chatbots," "AI chatbots in education," "AI in higher education," "AI chatbots management," "education management," "educational technology," "teaching and learning with AI chatbots," "AI chatbots for students," and "AI chatbots for teachers."

An initial pool of approximately 130 articles was identified: 85 articles from Scopus and 45 articles from Google Scholar. All articles sourced from Google Scholar were manually verified to ensure they were peer-reviewed journal publications.

Inclusion and exclusion criteria

Studies were included if they met the following criteria:

- Published in peer-reviewed journals between 2020 and 2025
- Indexed in Scopus or verified through manual review
- Focused on the use of AI chatbots in educational contexts
- Provided empirical findings or comprehensive reviews relevant to the research objectives

Studies were excluded if they:

- Focused on AI applications outside of education
- Were editorials, opinion pieces, or conference abstracts
- Lacked sufficient methodological rigor or transparency

Study selection

The study selection process followed the PRISMA 2020 flow, which involved four stages: identification,

screening, eligibility assessment, and inclusion. The PRISMA flow diagram (Figure. 3) summarizes the selection process. After removing duplicates and screening, 45 articles underwent full-text review. Of these, 30 articles met the inclusion criteria and were selected for in-depth analysis.

Data extraction

For each included study, data were systematically extracted using a structured template capturing author(s), year, journal, AI chatbots usage patterns, benefits, challenges, and management strategies. The extraction process was independently verified to ensure accuracy and consistency.

4. Data analysis

A thematic synthesis approach was employed to analyze the extracted data. Themes were identified inductively through iterative coding and were aligned with the four dimensions of the conceptual framework: usage, benefits, challenges, and management. This approach enabled a comprehensive synthesis of current knowledge and the identification of emerging patterns and best practices in AI chatbot integration within educational settings.

Results

This systematic literature review synthesized findings from 30 peer-reviewed articles published between 2020 and 2025. The results are organized to directly address each of the four research objectives.

1. Current Patterns of AI Chatbots Usage in Education

AI chatbots are widely used in various educational contexts to support both instructional and administrative tasks. In higher education, chatbots facilitate personalized learning, enabling self-paced study and adaptive feedback. They also promote collaborative learning through interactive peer-like interfaces. Beyond instruction, chatbots automate routine tasks such as grading, feedback, communication, and scheduling, thereby enhancing operational efficiency.

2. Perceived Benefits of AI Chatbots in Education

Key benefits include increased student engagement and motivation, enhanced academic skills (especially in writing and research), and improved access to learning resources. Chatbots offer timely feedback, support self-regulated learning, and create inclusive learning environments for diverse student populations. On the operational side, they reduce faculty workload by streamlining administrative tasks.

3. Key Challenges of AI Chatbots in Education

Challenges include concerns over data privacy and the security of sensitive student information. Ethical risks such as bias, misinformation, and threats to academic integrity have been identified. There is also a potential risk of over-reliance on AI-generated content, which may impede critical thinking and problem-solving development among students.

4. Evidence-based Management Strategies for AI Chatbot Integration

Effective management strategies include the development of clear institutional policies that align chatbot use with educational goals. Faculty training is essential to ensure appropriate integration into teaching practices.

AI chatbot design should prioritize meaningful learning experiences over automation. Ongoing evaluation and continuous improvement are necessary to maintain ethical standards and responsiveness to learner needs.

Table 2 Thematic synthesis of AI chatbots usage, benefits, challenges, and management strategies in education

Dimension	Thematic Synthesis of Findings
Usage	AI chatbots are used across various educational contexts to support personalized learning, self-regulated learning, and adaptive learning pathways. They are employed in language education, collaborative learning environments, and professional training. Additionally, AI chatbots are integrated into administrative processes to automate grading, provide feedback, manage communications, and support instructional design.
Benefits	AI chatbots enhance access to learning resources and provide personalized, immediate feedback, fostering self-paced learning. They promote student engagement and motivation, support the development of academic writing and research skills, and contribute to operational efficiency by automating routine educational and administrative tasks. Additionally, AI chatbots foster inclusive education by providing support to students with diverse learning needs.
Challenges	Key challenges include concerns about data privacy and the secure handling of student information. Ethical issues such as algorithmic bias, misinformation, and lack of transparency are frequently reported. Risks to academic integrity, including plagiarism and over-reliance on AI-generated content, are significant. Furthermore, there is concern about the potential erosion of critical thinking and higher-order cognitive skills among students due to extensive AI chatbots use.
Management	Effective management strategies emphasize the need for clear institutional policies and ethical guidelines. Faculty training and professional development are critical to enabling educators to integrate AI chatbots effectively and responsibly. AI chatbots should be designed to match the goals of the lessons and help create real, meaningful learning experiences. It is also important to keep reviewing and improving how these AI chatbots are used, so they stay useful, fair, and relevant as teaching and learning needs continue to change.

Table 2 provides a concise thematic summary that links the usage, benefits, challenges, and management of AI chatbots in education. It shows how chatbots support personalized learning and administration while raising concerns about data privacy, academic integrity, and critical thinking. The management section emphasizes the need for ethical policies and continuous evaluation. Overall, the table helps visualize how these elements interact and guide institutions in implementing AI chatbots responsibly.

Discussion

This systematic literature review explored the current landscape of AI chatbot integration in education by

synthesizing findings from 30 peer-reviewed articles. The results contribute valuable insights into usage patterns, perceived benefits, challenges, and management strategies, addressing the four objectives of the study.

The review confirms widespread adoption of AI chatbots in higher education and language learning, supporting personalized and administrative functions as shown in prior studies (Kuhail et al., 2023; Okonkwo & Ade-Ibijola, 2021; Romero Alonso et al., 2025).

In terms of benefits, AI chatbots significantly improve student engagement, motivation, and academic performance by providing real-time, personalized feedback and enabling anytime anywhere learning (D'Mello et al., 2024; Wiboolyasarin et al., 2025). Additionally, AI chatbots support academic skill development, particularly in writing and research, and foster greater learner autonomy (Kim et al., 2025; Winkler et al., 2023). These findings align with earlier studies (Chen et al., 2020; Ezzaim et al., 2023) that emphasize the potential of AI technologies to enhance educational outcomes and student experiences.

However, several challenges remain, concerns regarding data privacy and security (Almalki et al., 2025), as well as ethical issues, such as algorithmic bias and risks of misinformation (Heil et al., 2025; Winkler et al., 2023). Academic integrity is another prominent issue, with risks of plagiarism and over-reliance on AI-generated content (Dhamija & Dhamija, 2025; Kim et al., 2025). Furthermore, the findings suggest that lack of faculty preparedness and insufficient technical infrastructure may hinder effective integration (Yang et al., 2025), consistent with previous literature (Fullan et al., 2024).

To address these challenges, this review consolidates evidence-based management strategies. Key recommendations include the development of comprehensive policies and ethical guidelines, ensuring responsible AI use (Fullan et al., 2024; Yang et al., 2025). Faculty development is also critical; ongoing training will empower educators to utilize AI chatbots effectively while maintaining academic integrity (Meinlschmidt et al., 2025; Winkler et al., 2023). AI chatbot designs should align closely with educational objectives and be grounded in pedagogical theory (Ortiz et al., 2025). Finally, institutions should implement continuous evaluation frameworks to monitor AI chatbot performance and adapt to evolving educational needs (Saleh et al., 2025; Yang et al., 2025).

The limitations of this review include the limited number of empirical studies in certain disciplines and the rapidly changing nature of AI technologies, which may affect the long-term applicability of findings. Furthermore, the geographical distribution of the reviewed studies may limit generalizability across diverse educational contexts.

Implications for future research and practice are significant. Institutions should prioritize interdisciplinary collaboration between educators, technologists, and policymakers to ensure that AI chatbot integration supports ethical, effective, and learner-centered education. Future studies should explore longitudinal impacts of AI chatbot use and address gaps in underrepresented contexts and disciplines.

In summary, AI chatbots present great potential but require thoughtful, evidence-based integration to maximize benefits and minimize risks.

New Knowledge

This study contributes to the current understanding of AI chatbots in education by bringing together recent

research published between 2020 and 2025. While earlier studies, like the one by Okonkwo & Ade-Ibijola (2021), looked at how AI chatbots were first introduced into education, this study takes it further by focusing on more recent developments, especially during a time when AI has advanced quickly and concerns about ethics and teaching quality have grown. One of the main strengths of this study is its clear framework, which connects how AI chatbots are being used, the benefits they offer, the problems they raise, and how they can be managed responsibly. By reviewing 30 peer-reviewed articles from Scopus, this paper gives a well-rounded view of how AI chatbots are currently being used, what effects they have, and what schools and universities need to do to handle them well. It also points out new trends that past studies did not focus much on, such as the importance of designing AI chatbots to fit teaching goals. Ethical issues such as the concerns about honesty in academic work and the possible decline in students' critical thinking are also emphasized. Overall, this study helps build a stronger foundation for future studies, education policies, and school and university practices related to AI chatbots use.

Suggestions

1. Suggestions for applying research results

1.1 Institutions should develop clear, structured policies to guide the ethical use of AI chatbots in education, addressing data protection, academic integrity, and transparency.

1.2 Comprehensive training programs should be provided for educators to ensure effective technical use and meaningful pedagogical integration of AI chatbots.

1.3 AI chatbots should be designed to enhance, not replace, human interaction in the learning process, maintaining the critical role of teacher-student relationships.

1.4 Chatbot functionalities should align with specific lesson objectives to foster greater engagement and improve learning outcomes.

1.5 Schools and universities should establish continuous review and improvement processes to ensure AI chatbot usage remains effective, equitable, and responsive to evolving educational needs.

2. Suggestions for future research

2.1 Future studies should conduct longitudinal research to examine the long-term effects of AI chatbots on student learning, with particular attention to the development of critical thinking skills.

2.2 Further investigation is needed to identify which management practices and AI chatbot design features most effectively enhance learning outcomes in real-world classroom settings.

2.3 Comparative studies across diverse cultural and educational contexts are recommended to better understand how these factors influence the adoption and effectiveness of AI chatbots in education.

2.4 Interdisciplinary research that integrates perspectives from education, computer science, and ethics is encouraged to inform the development of AI chatbot applications that promote both educational effectiveness and responsible use.

References

Adams, D., & Thompson, P. (2025). Transforming school leadership with artificial intelligence: Applications, implications, and future directions. *Leadership and Policy in Schools, 24*(1), 77–89. https://doi.org/10.1080/15700763.2024.2411295.

Almalki, M., Alkhamis, M. A., Khairallah, F. M., & Choukou, M.-A. (2025). Perceived artificial intelligence readiness in medical and health sciences education: A survey study of students in Saudi Arabia. *BMC Medical Education, 25*, 439. https://doi.org/10.1186/s12909-025-06995-1.

Black, R. W., & Tomlinson, B. (2025). University students describe how they adopt AI for writing and research in a general education course. *Scientific Reports, 15*, 8799. https://doi.org/10.1038/s41598-025-92937-2.

Carson, L. (2024). Extending the dialogic space: Developing interprofessional expertise through a student-created podcast. *Scandinavian Journal of Educational Research, 68*(5), 1039–1054. https://doi.org/10.1080/00313831.2023.2196287.

Chen, X., Xie, H., Zou, D., & Hwang, G. J. (2020). Application and theory gaps during the rise of artificial intelligence in education. *Computers and Education: Artificial Intelligence, 1*, 100002. https://doi.org/10.1016/j.caeai.2020.100002.

Dhamija, A., & Dhamija, D. (2025). Understanding teachers' perspectives on ChatGPT-generated assignments in higher education. *Journal of Interdisciplinary Studies in Education, 14*(1), 38–62. https://doi.org/10.32674/ptf9yd75.

D'Mello, S. K., Biddy, Q., Breideband, T., Bush, J., Chang, M., Cortez, A., Flanigan, J., Foltz, P. W., Gorman, J. C., Hirshfield, L., Ko, M.-L. M., Krishnaswamy, N., Lieber, R., Martin, J., Palmer, M., Penuel, W. R., Philip, T., Puntambekar, S., Pustejovsky, J., et al. (2024). From learning optimization to learner flourishing: Reimagining AI in education at the Institute for Student-AI Teaming (iSAT). *AI Magazine, 45*(1), 61–68. https://doi.org/10.1002/aaai.12158.

Elliott, M., Williams, J., Aldwikat, R., & Wong, P. (2025). Using ChatGPT to enhance student learning: A case study in a nursing curriculum. *Teaching and Learning in Nursing, 20*(2), e309–e312. https://doi.org/10.1016/j.teln.2024.09.009.

Ezzaim, A., Dahbi, A., Haidine, A., & Aqqal, A. (2023). AI-based adaptive learning: A systematic mapping of the literature. *Journal of Universal Computer Science, 29*(10), 1161–1197. https://doi.org/10.3897/jucs.90528.

Fošner, A., & Aver, B. (2025). AI chatbots in higher education: Students' beliefs and concerns. *Sustainable Futures, 9*, 100734. https://doi.org/10.1016/j.sftr.2025.100734.

Fullan, M., Azorín, C., Harris, A., & Jones, M. (2024). Artificial intelligence and school leadership: Challenges, opportunities and implications. *School Leadership & Management, 44*(4), 339–346. https://doi.org/10.1080/13632434.2023.2246856.

Heil, J., Ifenthaler, D., Cooper, M., Mascia, M. L., Conti, R., & Penna, M. P. (2025). Students' perceived impact of GenAI tools on learning and assessment in higher education: The role of individual AI competence. *Smart Learning Environments, 12*, 37. https://doi.org/10.1186/s40561-025-00395-0.

Kang, J.-Y. M., Lee, J. Y., Choi, D., & Koo, S. H. (2024). Artificial intelligence-powered AI chatbots in the fashion sector: The Affect–Behavior–Cognition model of attitudes. *Family and Consumer Sciences Research Journal, 53*(1), 5-24. https://doi.org/10.1111/fcsr.12521.

Kim, S-K., Kim, T-Y., & Kim, K. (2025). Development and effectiveness verification of AI education data sets based on constructivist learning principles for enhancing AI literacy. *Scientific Reports, 15*, 10725. https://doi.org/10.1038/s41598-025-95802-4.

Kuhail, M. A., Alturki, N., Alramlawi, S., & Alhejori, K. (2023). Interacting with educational chatbots: A systematic review. *Education and Information Technologies, 28*, 973–1018. https://doi.org/10.1007/s10639-022-11177-3.

Lan, M., & Zhou, X. (2025). A qualitative systematic review on AI-empowered self-regulated learning in higher education. *npj Science of Learning, 10*, 21. https://doi.org/10.1038/s41539-025-00319-0.

Mat Yusoff, S., Mohamad Marzaini, A. F., Hao, L., Zainuddin, Z., & Basal, M. H. (2025). Understanding the role of AI in Malaysian higher education curricula: An analysis of student perceptions. *Discover Computing, 28*, 62. https://doi.org/10.1007/s10791-025-09567-5.

Meinlschmidt, G., Koc, S., Boerner, E., Tegethoff, M., Simacek, T., Schirmer, L., & Schneider, M. (2025). Enhancing professional communication training in higher education through artificial intelligence (AI)-integrated exercises: Study protocol for a randomised controlled trial. *BMC Medical Education, 25*, 804. https://doi.org/10.1186/s12909-025-07307-3.

Okonkwo, C. W., & Ade-Ibijola, A. (2021). AI chatbots applications in education: A systematic review. *Computers and Education: Artificial Intelligence, 2*, 100033. https://doi.org/10.1016/j.caeai.2021.100033.

Ortiz, A., Patiño, S., Torres, J., Mármol, J., Serafin, C., Dodhia, R., Saidman, G., Schbib, V., Peña, B., Monteoliva, G., Martinez-Castellanos, M. A., Weeks, W. B., & Lavista Ferres, J. M. (2025). AI-enabled screening for retinopathy of prematurity in low-resource settings. *JAMA Network Open, 8*(4), e257831. https://doi.org/10.1001/jamanetworkopen.2025.7831.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. https://doi.org/10.1136/bmj.n71.

Romero Alonso, R., Araya Carvajal, K., & Reyes Acevedo, N. (2025). Role of artificial intelligence in the personalization of distance education: A systematic review. *RIED-Revista Iberoamericana de Educación a Distancia, 28*(1), 9-32. https://doi.org/10.5944/ried.28.1.41538.

Salama, N., Bsharat, R., Alwawi, A., & Khlaif, Z. N. (2025). Knowledge, attitudes, and practices toward AI technology (ChatGPT) among nursing students at Palestinian universities. *BMC Nursing, 24*, 269. https://doi.org/10.1186/s12912-025-02913-4.

Saleh, Z. T., Rababa, M., Elshatarat, R. A., Alharbi, M., Alhumaidi, B. N., Al-Za'areer, M. S., Jarrad, R. A., Al Niarat, T. F., Almagharbeh, W. T., Al-Sayaghi, K. M., & Fadila, D. E. S. (2025). Exploring faculty perceptions and concerns regarding artificial intelligence AI chatbots in nursing education: Potential benefits and limitations. *BMC Nursing, 24,* Article 440. https://doi.org/10.1186/s12912-025-03082-0.

Shearing, H. (2025). *Teachers can use AI to save time on marking, new guidance says.* BBC News. Retrieved May 29, 2025, from https://www.bbc.com/news/articles/c1kvyj7dkp0o.

Tang, P. (2024). *AI textbooks and AI chatbots are already changing the way students learn. Should they?* CBC News. Retrieved May 29, 2025, from https://www.cbc.ca/news/canada/ai-textbooks-education-1.7302095.

The Business Research Company. (2025). *Artificial Intelligence (AI) chatbot global market report 2025.* Retrieved May 29, 2025, from https://www.thebusinessresearchcompany.com/report/artificial-intelligence-ai-chatbot-global-market-report.

Tortella, F., Palese, A., Turolla, A., Castellini, G., Pillastrini, P., Landuzzi, M. G., Cook, C., Galeoto, G., Giovannico, G., Rodeghiero, L., Gianola, S., & Rossettini, G. (2025). Knowledge and use, perceptions of benefits and limitations of artificial intelligence AI chatbots among Italian physiotherapy students: A cross-sectional national study. *BMC Medical Education, 25,* 572. https://doi.org/10.1186/s12909-025-07176-w.

Trindade, M. A. M., Edirisinghe, G. S., & Luo, L. (2025). Teaching mathematical concepts in management with generative artificial intelligence: The power of human oversight in AI-driven learning. *The International Journal of Management Education, 23*(2), 101104. https://doi.org/10.1016/j.ijme.2024.101104

Wiboolyasarin, W., Wiboolyasarin, K., Tiranant, P., Jinowat, N., & Boonyakitanont, P. (2025). AI-driven AI chatbots in second language education: A systematic review of their efficacy and pedagogical implications. *Ampersand, 14*, 100224. https://doi.org/10.1016/j.amper.2025.100224

Winkler, C., Hammoda, B., Noyes, E., & Van Gelderen, M. (2023). Entrepreneurship education at the dawn of generative artificial intelligence. *Entrepreneurship Education and Pedagogy, 6*(4), 579–589. https://doi.org/10.1177/25151274231198799.

Xiao, Y., & Watson, M. (2017). Guidance on conducting a systematic literature review. *Journal of planning education and research*, *39*(1), 93-112. https://doi.org/10.1177/0739456X17723971.

Yang, Y., Zhang, Y., Sun, D., He, W., & Wei, Y. (2025). Navigating the landscape of AI literacy education: Insights from a decade of research (2014–2024). *Humanities and Social Sciences Communications, 12*, 374. https://doi.org/10.1057/s41599-025-04583-8.

Zapata, G. C., Saini, A. K., Tzirides, A. O. O., Cope, W., & Kalantzis, M. (2024). The role of AI feedback in university students' learning experiences: An exploration grounded in activity theory. *Ubiquitous Learning: An International Journal, 18*(2), 1–30. https://doi.org/10.18848/1835-9795/CGP/v18i02/1-30.

Zhang, J., Song, W., & Liu, Y. (2025). Cognitive bias in generative AI influences religious education. *Scientific Reports, 15*, 15720. https://doi.org/10.1038/s41598-025-99121-6.